

Kelly M. Hatfield, MSPH¹, James Baggs, PhD¹, Lisa G. Winston, MD^{2,3}, Erin Parker, MPH³, Brittany Martin, MPH³, James I. Meek, MPH⁴, Danyel Olson, MS, MPH⁴, Monica M. Farley, MD, FIDSA^{5,6}, Andrew Revis, MPH⁵, Stacy Holzbauer, DVM, MPH, DACVPM⁷, Maria Bye, MPH⁷, Lucy Wilson, MD, ScM⁸, Rebecca Perlmutter, MPH⁸, Erin C. Phipps, DVM, MPH⁹, Rebecca Pierce, PhD, MS, BSN¹⁰, Valerie L.S. Ocampo, RN, MPH¹⁰, Marion A. Kainer, MBBS, MPH, FSHEA¹¹, Miranda Smith, MPH¹¹, L. Clifford McDonald, MD¹, John A. Jernigan, MD, MS¹ and Alice Guh, MD, MPH¹
 (1)Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, GA, (2)Medicine, University of California, San Francisco and Zuckerberg San Francisco General Hospital and Trauma Center, San Francisco, CA, (3)California Emerging Infections Program, Oakland, CA, (4)Connecticut Emerging Infections Program, Yale School of Public Health, New Haven, CT, (5)Department of Medicine, Emory University School of Medicine and Atlanta VA Medical Center, Atlanta, GA, (6)Georgia Emerging Infections Program, Atlanta, GA, (7)Infectious Disease Epidemiology, Prevention, and Control Division, Minnesota Department of Health, St. Paul, MN, (8)Maryland Department of Health and Mental Hygiene, Baltimore, MD, (9)New Mexico Emerging Infections Program, University of New Mexico, Albuquerque, NM, (10)Acute and Communicable Disease Prevention, Oregon Health Authority, Portland, OR, (11)Tennessee Department of Health, Nashville, TN

Background

Clostridioides difficile infection (CDI) is a common healthcare-associated infection, particularly among older adults.

CDC performs active population and laboratory based surveillance for CDI through the Healthcare-Associated Infections - Community Interface within the Emerging Infections Program (EIP). We will use linked surveillance and administrative data to measure variation in one-year outcomes attributable to CDI among persons aged ≥ 65.

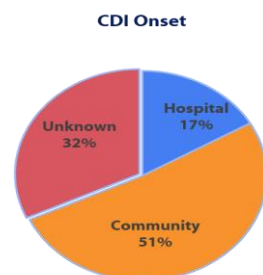
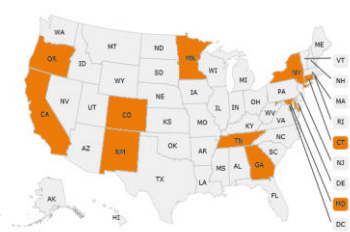
Study Population: EIP 2014-2015

Data are collected from 10 catchment areas surveilling 11.7 million people.

33,683 cases reported

29,932 unique patients
 *included only first case for each patient

14,600 age ≥ 65 at event date



Case definition:

A positive *C. difficile* stool test in a person residing within the catchment area without a positive test in the prior 8 weeks

CMS Data: Research Identifiable Files

Medicare is a federal health insurance program for those aged 65 and older. CMS data include inpatient and outpatient claims, assessments, surveys, enrollment/summary files and include:

- Admission and discharge dates
- Diagnoses and Procedures
- Sources of care
- Demographic data, such as age, date of birth, race, place of residence, date of enrollment, and date of death

Methods: Data Linkage: EIP ↔ CMS

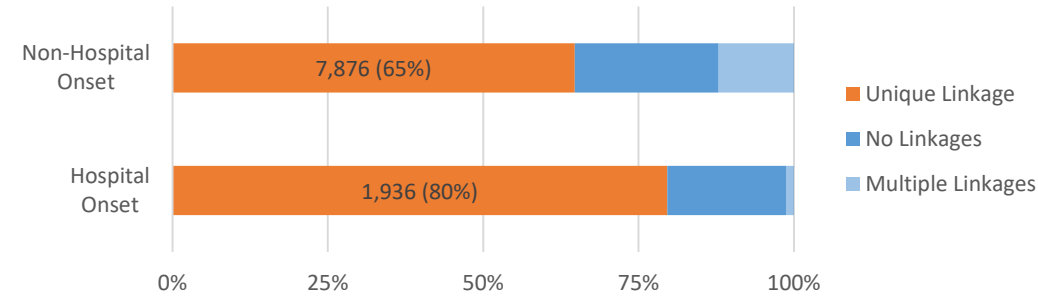
- Linked on **birthdate, gender, county of residence** for all linkages
- Non-HO linkages also linked on **exact zip code or admission date match**
- HO-linkages linked on **admission date (+/-3 days) and discharge date** (when available). *Specimen date must be during hospitalization or within 3 days of discharge (per EIP definitions)*

14,600 cases eligible

9,812 linked uniquely (67%)
 10% cases had multiple linkages
 23% had no linkages

5,680 met inclusion (60%)
 Continuous fee-for-service coverage one year before and after event date (or until death)

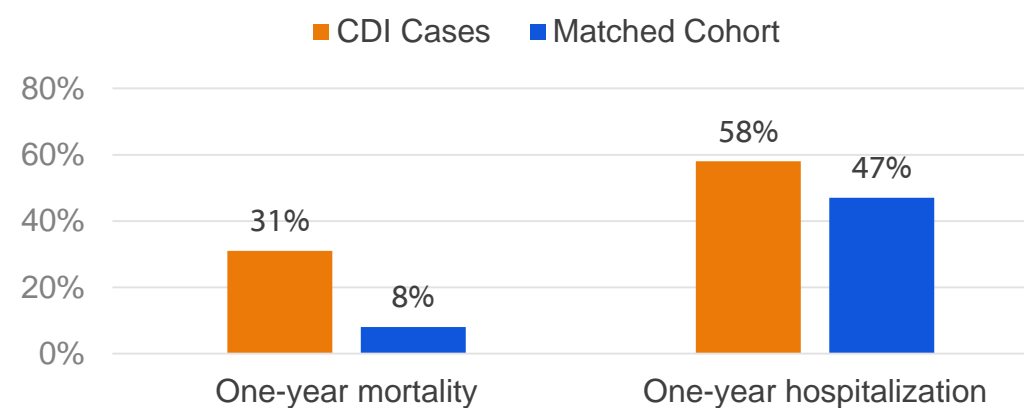
Linkage Success Varied by Onset



Each Linked Case Matched to up to 5 Controls

- Matched on catchment area with same inclusion criteria
- Matches must have **no** claims (inpatient or outpatient) for CDI one year prior to the matched event date on catchment area
- HO cases were matched to hospitalized beneficiaries with a length of stay ≥ time to CDI onset

Results: Final Analytic Dataset



Hospital Onset

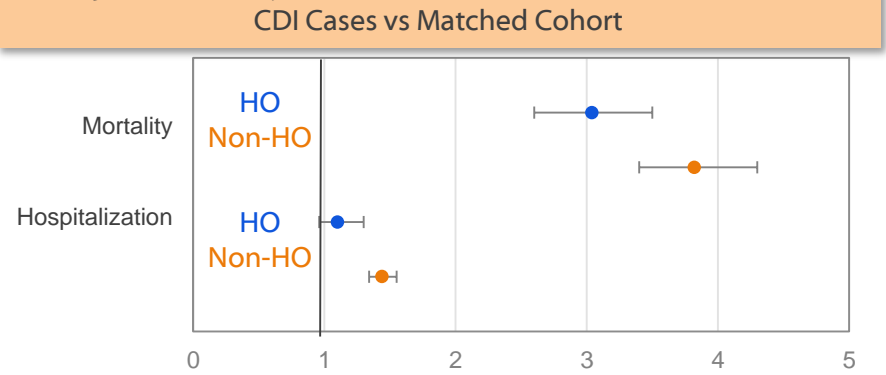
| | CDI Cases N=1,141 | Matched Cohort N=5,607 |
|--|----------------------|---------------------------|
| Age (% over 80) | 45% | 42% |
| Sex (% Male) | 43% | 44% |
| Race (% White) | 80% | 81% |
| Length of stay | 15.5 (8.3) | 13.4 (18.5) |
| Mechanical Ventilation¹ | 19% | 8% |
| ICU Status ² | 48% | 31% |
| Skilled Nursing Facility Resident³ | 36% | 28% |
| # hospitalizations in year prior Mean (SD) | 1.73 (1.9) | 2.3 (4.0) |
| One year re-hospitalization | 57% | 53% |
| One year mortality | 44% | 18% |
| Median days from event until death, among those who died in 1 year (IQR) | 41 (13-118) | 72 (18-189) |

Non-Hospital Onset

| | CDI Cases n=4,539 | Matched Cohort N=22,691 |
|--|----------------------|----------------------------|
| Age (% over 80) | 47% | 40% |
| Sex (% Male) | 39% | 43% |
| Race (% White) | 83% | 84% |
| Skilled Nursing Facility Resident³ | 33% | 0.6% |
| # hospitalizations in year prior Mean (SD) | 1.4 (1.7) | 0.7 (1.0) |
| One year hospitalization | 58% | 45% |
| One year mortality | 28% | 6% |
| Median days from event until death, among those who died in 1 year (IQR) | 43 (14 -124) | 202 (101 - 288) |

Tables show N(%) or Mean (Standard Deviation) Bold print indicates statistically significant differences between CDI cases and the matched cohort
¹ Before event date in primary hospitalization
² At any point in primary hospitalization. Identified through any revenue center code for any ICU type on any claim for the stay.
³ Defined as residence identified through Minimum Dataset (MDS) in 90 days preceding the event date

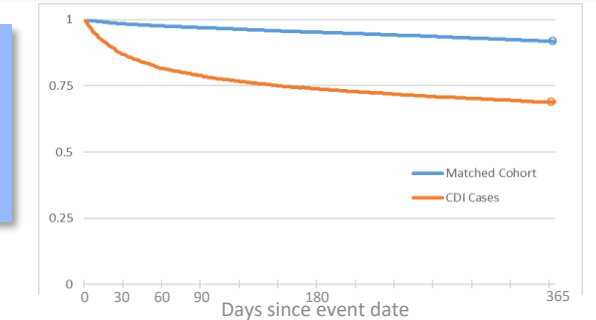
Adjusted 1 year Outcomes Odds Ratios



*Modeled using multivariable logistic regression in SAS v9.4. Adjusted for age, sex, race, catchment area, mechanical ventilation (HO only), skilled nursing facility (SNF) residence, number of hospitalizations in prior year, and Medicare identified chronic conditions present before CDI onset date/match date

Kaplan Meier Survival Curves

CDI cases have significantly higher probability of death throughout the following year.



Conclusions

Older adults with CDI have **over three times higher odds of mortality** in the year following CDI compared to a matched cohort.

- Persists when matching on length of hospitalization and adjusting for SNF residence, severity of illness and chronic conditions.
- This difference in risk is sustained for the year following CDI

Older adults with non-hospital onset CDI have **over 40% increase in odds of hospitalization** in the subsequent year.

Population based surveillance data can be successfully linked to large administrative claims/healthcare payer datasets using a limited number of identifiers

- Having known dates of hospitalization improves linkage and decreases duplicate linkages

CONTACT: Kelly Hatfield (UYL3@cdc.gov)

